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VOCATIONAL AGRICULTURE IN THE HIGH SCHOOL

A Bulletin of General Information

By

W. F. STEWART
Professor of Agricultural Education
State Supervisor of Agricultural Education

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COLUMBUS

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PREFACE

The development of departments of vocational agriculture has assumed such form, and interest in the operation of the state plan has become so awakened, that a general statement of the operations of the plan, the procedure in securing and maintaining departments, and factors associated with their success, has seemed advisable. This bulletin has, therefore, been prepared to furnish its readers with information concerning the actual working conditions of the Ohio plan and with general information on instruction in vocational agriculture.

If a complete exposition of vocational teaching were prepared, it would be necessary to reproduce, in part at least, the federal act providing for vocational education and the Ohio plan for carrying out the provisions of that act. As this information is available from other sources (Public Document No. 347, Sixty-fourth Congress, and The Ohio State Plan for Vocational Education), the content of this bulletin will be confined to a discussion of topics which are in part outgrowths of the state plan and more closely related to actual working conditions in the high schools. In the discussion of many phases of the work, the field will not be covered with sufficient thoroughness to acquaint teachers of vocational agriculture with the details of their assigned duties. Such information may be secured from special courses for the training of teachers of vocational agriculture. But a general survey of the operations of the Ohio plan, in so far as they apply to instruction in vocational agriculture, will be made for the benefit of boards of education, superintendents, principals, and others interested in the promotion of agricultural instruction in the state.

The centralized high school with 30 or more farm boys in attendance, has proved especially well adapted to the promotion of instruction in Vocational Agriculture. Lanier Township School, Preble County.

VOCATIONAL AGRICULTURE IN THE HIGH SCHOOL

A BULLETIN OF GENERAL INFORMATION

Instruction in vocational agriculture has made marked progress in Ohio since receiving impetus in 1917 from the acceptance of the Act for the Promotion of Vocational Education. During the year 1917-18 seventeen departments of vocational agriculture were approved for the second semester. In 1918-19 forty-three departments received approval. This year the number has been increased to sixty-two. The number of new schools applying for departments each year has been about fifty.

This growth has been made in the face of wartime conditions, which created a marked shortage of teachers. With a return to more nearly normal conditions, and the benefit of a better understanding of the work over the state, more rapid progress may be expected in developing departments. In fact, there are indications at present that schools realizing the value of such instruction are planning to develop departments independently, if necessary, of federal-state aid.

The administration of vocational education in this state was placed under the direction of a State Board of Education by the legislature at the time it accepted the provisions of the Federal Act. This Board consists of six members appointed by the Governor for six years and the State Superintendent of Public Instruction, ex officio. The plan for developing vocational education in this state has been prepared by this Board with the approval of the Federal Board for Vocational Education and is available for distribution from the Department of Public Instruction as "The Ohio State Plan for Vocational Education."

When vocational instruction was first undertaken in this state, no schools applied which were already meeting the requirements for vocational teaching. It thus became expedient for all schools desiring the approval of the State Board of Education to take such steps as were necessary by providing equipment, apparatus, etc. This condition, along with the straitened finances of most school treasuries, made it desirable to assure schools in advance that if they would meet the requirements of the State Board of Education they would receive approval and reimbursement as provided. Consequently a plan of pre-approval was adopted, as will be explained later, which is still in use.

HOW APPROVAL IS GRANTED

Schools seeking approval file their applications upon blanks furnished them by the state supervisor or the State Board of Education. Applications should be filed by March 1 if it is desired to have the departments ready for final approval in July or August. In order to begin work the second semester applications should be filed in November. On account of the greater number of qualified teachers available in June, a much larger number of schools is approved at that season than in the winter.

Each application is placed on file and receives consideration after local conditions are studied. Additional information bearing upon conditions in each school applying may be obtained, if needed, by the state supervisory staff, members of the State Board of Education, members of the Department of Public Instruction, or other agencies having reliable information concerning the schools in question. With this information at hand, the State Board of Education selects the schools in which they deem it most desirable to support departments of vocational agriculture. These schools are then notified that pre-approval has been granted them. By pre-approval is meant that the assurance of the State Board is given to all schools receiving such notification that they may proceed to meet the prescribed requirements by hiring a qualified teacher, equipping classroom and laboratory, providing apparatus and reference books, and organizing a curriculum for vocational pupils, knowing that when these requirements have been met and reported to the State Board, final approval will be granted by that Board and contracts issued. All contracts expire at the close of the fiscal year, but are renewable so long as they are not violated.

Several important factors are considered in granting pre-approval for vocational instruction. A vocational department cannot ordinarily be a success in a community where those who are farming are more interested in certain trade and industrial opportunities than they are in the real duties of the farm. With such people farming might be termed an avocation, and mining or shopwork or teaming their vocational interest. Also whole-hearted community support is necessary for the assured success of a department. Factions are not assets, no matter from what cause they may arise. A community where town and country are cooperating, where local differences do not segregate the people, and where the majority are working for the community's common good, is a favorable environment where a department will thrive. Again, a desirable community in which to locate a department is one interested in the improvement of the rural-minded pupils and not given to a smug satisfaction of "ancestral worship," in which a feeling seems to assert itself that "whatever was good enough for me is good enough for my children," and "the kind of farm practice which I use is good enough for my boys." Freedom from such community conditions and individual types gives assurance that vocational instruction will be profitable both in the classroom and on the farm where the pupil may enter into the application of his instruction with parental cooperation.

In the board of education a successful department demands an informed, sympathetic, and interested membership. When members do not acquaint themselves with the plan for vocational education, misunderstandings will arise in the development of the department. When they have no sympathy with or interest in vocational education, the requirements for maintenance will not be willingly met, so that without these qualifications progress is quite impossible.

Also a board of education with one, two, three, or four active members does not equal a board of five active, informed, progressive members, whose interests have the welfare of the entire community at heart and not the desires of a particular group.

Aside from the vocational teacher, the superintendent is the surest indication of the success or failure of a department. It is, therefore, especially necessary that he be in sympathy with vocational education. More than that, he must be a believer in vocational education and not so steeped in classical learning that he can see at the end of a high school course only entrance to a college curriculum. Without the direction of a superintendent possessing active sympathetic interest in vocational instruction, the success of a department would be questionable from the very beginning and, therefore, approval is not encouraged. Even from the superintendent with the vocational viewpoint, there is need for special assistance in the organization of the agricultural curriculum by providing proper coordination in the several departments. Opportunity for such cooperation is found in the linking of the science courses —Biology, Chemistry, and Physics—and, in a less degree, the other subjects of the curriculum with the interests of the vocational pupils without detracting from the value of these courses to other pupils in the classes. Also the superintendent must not be a slave to a system in which the pupils pay the price, but rather he must recognize in vocational teaching, instruction of a different type and requiring greater variation and more informality than the customary classroom courses. Absence of classes for field trips, farm laboratory practice, and other forms of out-of-school instruction will be understood as necessary for the best results and quite superior to any program whereby the teaching of agriculture might be attempted entirely under schoolroom conditions. Finally, the superintendent must be acquainted with the duties of the agricultural teacher, and with the needs of the teacher and the depart-

This township school, built at a cost of $150,000, provides ample quarters for the high school and the grades, departments of Vocational Agriculture and Home Economics, a Farm Shop, an Auditorium equipped with 500 opera seats, stage, scenery, etc., and a Gymnasium of ample size, with dressing rooms and shower baths in connection. An ideal center for the promotion of all good things, socially, educationally, and agriculturally, for the betterment of rural life. Bethel Township School, Miami County.

ment. He may be of great assistance in developing the work in its many phases, assuming that the teacher with special training will be qualified to direct the instruction and solve the technical problems in his special field and to pass judgment on the qualifications of pupils who may wish to enroll.

Pupils interested in agricultural instruction and qualified to meet the requirements for supervised farm practice, which will be explained later, constitute a most important essential for a successful department. Especially while the work is new should the emphasis be placed upon the number of qualified pupils who may be expected to elect the course. While there is nothing to prohibit any pupil from electing the course who can satisfy the requirements for supervised farm practice, the so-called home project under farm conditions, nevertheless, there is only one standard for practical work and all pupils must meet this standard. For this reason girls and town boys must realize that it will require special efforts for them to meet the entrance requirements, particularly in arranging for farm practice of satisfactory scope. Also without depreciating the possibility and desirability of certain town-reared boys eventually engaging in farming, nevertheless it is very evident that the farmers of tomorrow will come, for the most part, from the farms of today, and, therefore, great emphasis is placed upon the number of farm boys who are attending school as the most reliable basis for judging the possible enrollment in a department. For the benefit of pupils who cannot meet the vocational requirements or who are not interested in agriculture from a vocational standpoint, a course in general agriculture is recommended.

In material things, adequate classroom and laboratory space for housing the department is essential. The size and the location of the room or rooms may vary somewhat, depending upon the number of pupils in the department and the general plan of the room. For a department of thirty or thirty-five pupils, a room with 600 or 750 square feet of floor space will usually prove adequate. A small room for additional storage space is an added advantage. In some old school buildings it is quite impossible to find satisfactory rooms available without the outlay of considerable money for alterations and repairs. In more modern buildings very satisfactory quarters are frequently found in the "above-ground" basement, preferably with a direct outside entrance available and with a southern exposure.

Equipment consists of such facilities as cabinets (for the storage of apparatus and laboratory and illustrative material), blackboards, recitation tables, laboratory tables, chairs, water, light, gas, etc., provided in such amount and arrangement as will serve best in the presentation of agricultural information. Likewise, apparatus and reference books are also necessary and are required in such quantity and variety as meet the needs of the department for efficient work in the particular community in which it is located. For a more complete discussion of this subject, see Bulletin I, Rooms for a Department of Vocational Agriculture, Their Location, Plan, and Equipment.

For equipping and maintaining a department, for the salaries of teachers of non-vocational subjects, and for paying the salary of the vocational teacher until reimbursement is made, local funds must be available. It is, therefore, evident that the department is not a gift, nor is vocational legislation intended to provide an opportunity to save the salary of a teacher. Instead, it is simply a provision whereby an education for a particular vocation is offered a group of pupils with similar interests. A teacher with special training is required for the technical instruction, as is hereafter explained.

Vocational Agriculture Class Bloomville O.

"Winners of the standing broad smile." Their faces indicate the effects of the agricultural course on boys who are in daily contact with the farm. Bloomville Agricultural Department.

APPARATUS, EQUIPMENT, AND REFERENCE BOOKS

When a board of education receives notification from the State Board of Education that their application has been granted pre-approval, they should then proceed to hire a qualified teacher and secure approval of his qualifications and salary from the State Board of Education. Necessary apparatus and reference books for the department must be ordered at once, in order that these supplies may be received, and thus assure final approval, before the opening of the school year. Likewise, the equipment for the room or rooms to be given to vocational agriculture must be installed as planned by the supervisor at the time of his visit. Most of the equipment may be constructed or installed locally. Members of the supervisory staff are always willing to advise with the local board of education and the teacher of agriculture with reference to the kind and amount of apparatus and equipment to be provided and also the choice of library reference books. The policy of the state department with reference to orders for apparatus is that the choice of the commercial house from which the apparatus will be ordered is left to local authorities for decision, while the services and suggestions of the members of the department are available only for the purpose of helping local boards secure satisfactory apparatus most economically and promptly. Several commercial houses furnish apparatus in whole or in part for agricultural departments.

A few carefully selected reference books with several copies of those used most frequently are recommended, rather than the extensive ordering of agricultural books without regard to content or application. Forty or fifty books with duplicate copies as suggested will usually suffice. A suggested list of reference books is included in this bulletin.

THE TEACHER

The teacher of vocational agriculture must possess the following qualifications:

1. He must be a graduate in agriculture of a college of agriculture, or offer equivalent training.
   A graduate in the scientific course of a non-agricultural college may qualify as a vocational teacher upon the completion of fifty-four semester hours of carefully selected courses in technical agriculture in a College of Agriculture. This is equivalent to a summer session, a resident year, and a second summer session at the Ohio State University.
2. He must have had at least two years of farm experience since reaching the age of fourteen.
3. He must have completed professional educational courses sufficient to enable him to be certificated as a teacher of vocational agriculture. (For the present, eighteen semester hours are required for a life certificate without examination.)
4. He must possess such personal qualifications as are desirable in teachers in charge of high school pupils.

The teacher is hired for the fiscal year with a vacation not to exceed four weeks at a time when his services are least needed. The hiring of teachers is in the hands of the local boards of education, with the provision that approval of the qualifications and salaries must be granted by the State Board of Education. If requested, the Department of Agricultural Education will recommend candidates whenever qualified candidates are known.

In considering the employment of a teacher, the following duties of the agricultural teacher should be kept in mind:

1. He must teach the agricultural classes, using as agencies the recitation, laboratory, and home farm, as the subject matter demands. He may teach Farm Shop if qualified to do so.
2. He must organize and supervise the pupils' farm practice or home projects in connection with the subject matter studied. For this, adequate transportation is required.
3. He must provide an abundance and a variety of useful illustrative material as an aid in visualizing instruction.
4. He must arrange a winter short course for farm boys who are not in school or for farmers, whenever it is possible.
5. He must conduct community work as available time permits, in which he cooperates with the local agencies in promoting the best agricultural interests of the community, with the county agent and the leaders of boys' and girls' club work, and in such other ways as his services may be of value for the betterment of rural life.

With these duties in mind, the local board of education should be able to consider applicants with a view to selecting the one who is best qualified for the position. Approval of the qualifications of the applicants and the salary towards which reimbursement will be made must be secured from the State Board of Education. Following the granting of such approval, the State Board of Education issues contracts covering the agreement for the fiscal year.

REIMBURSEMENT

After a local board of education has paid the salary of the vocational teacher monthly, reimbursement will be made semi-annually to the school treasurer, on January 1 and July 1, upon proper filing of an affidavit by the clerk or treasurer. This affidavit will be mailed to the clerk about ten days before date of filing. Heretofore reimbursement has been made for eighty percent of an approved salary up to $1800; for the portion of a salary beyond that amount, no reimbursement has been paid. Effective July 1, 1920, reimbursement will be made for eighty percent of an approved salary up to $2000, and for fifty percent of the portion of an approved salary between $2000 and $2500. It is quite possible that reimbursement may revert to the former plan when legislation is enacted, providing relief for schools, in order that the funds may be distributed among a larger number of schools.

THE AGRICULTURAL CURRICULUM

In preparing a curriculum in vocational agriculture for a first-grade high school, several factors must be kept in mind. The most important of these is that the curriculum must be designed to "meet the needs of persons over fourteen years of age who have entered upon or who are preparing to enter upon the work of the farm." Briefly this means that the course must serve a group of boys whose aim in high school education is to prepare themselves for the vocation of farming, rather than merely provide agricultural instruction general in nature and of equal value to the group who may be preparing for professional life and further education of college rank. At present only one teacher of vocational subject matter is available. This is due to the scarcity of quali-

An orderly classroom equipped for service, a supply of timely illustrative material, an interested teacher, and an enthusiastic class assure satisfactory results both in the classroom and in farm practice. Grove City Department.

fied teachers, to the desire to distribute the benefits of the work into as many schools as possible, and also to the fact that one teacher is adequate so long as the enrollment in any department is small and combination of classes and alternation of courses is possible, particularly in the junior-senior group.

In the presentation of vocational units, a vocational period of ninety minutes is required. On account of the limitation to one teacher of vocational subjects, the foundation science courses—Biology, Chemistry, and Physics—must be offered separately rather than with the vocational subject matter, and therefore, must be taught by the teacher of science rather than by the vocational teacher. The science courses should be presented logically as a preparation for the application of agricultural science. This makes it necessary to offer the fundamental science preceding or concurrent with its application in agricultural subject matter. Recognition of this fact also provides for coordination with the psychological development of the pupil. Thus Biology should be offered with Farm Crops, Chemistry with Soil Fertility, and Physics with Agricultural Engineering.

Non-vocational subjects should be offered for the purpose of developing well-rounded training for efficient citizenship, after desirable agricultural courses have been provided for; or, in other words, while the agricultural subjects are the most important to the agricultural pupil, nevertheless some consideration should be given to the selection of a variety of additional subjects that will aid in the all-around development of the pupil. In some instances consideration must be given to what is already offered in a school or to what text books are available, rather than to what is desired. For instance, it is probable that a year's work in Mathematics, covering the essential parts of Algebra, Geometry, and the elements of Trigonometry, could be combined effectively into a one-year course in high school Mathematics. But as such a text is not available at present, those pupils wishing such information must of necessity elect the present courses in Algebra and Plane Geometry. Conditions somewhat similar arise with reference to science courses, Rural Economics, and Rural Sociology. It is very probable that improvement will soon be made in available text books.

Agricultural units must be varied to suit local community needs. The community in which Horticulture is a predominating interest should schedule its agricultural courses to provide well for this subject. On the other hand, the community in which general farming predominates would place less emphasis on Horticulture. But in this connection it should be recognized that certain agricultural studies such as crop production, animal husbandry production, dairying, and soils, should receive at least a minimum amount of attention because no farm boy should be considered trained in an agricultural course of even secondary grade until he has completed at least an introductory study in each of these important divisions of agricultural subject matter. They should, therefore, receive definite consideration in every vocational curriculum in Ohio.

Psychological factors must be considered in organizing the work. Farm Shop, as a course of interest to the pupils at a period when activity and manipulation are predominating instincts, should be scheduled in the early years of the course. Likewise, Farm Crops offers the best basis of instruction for developing the pupil's mind from the known to the unknown, from the easy to the more difficult, and should be scheduled early. Animal Husbandry ranks nearly as high as Farm Crops in this measurement. Of the more complex subjects, Chemistry and Soils in like manner deserve consideration later in the curriculum when the student's mind is more mature and his imagination is keener.

The varying individuality of pupils deserves consideration, particularly with reference to the offering of electives. If any considerable number of vocational pupils should be unable to master certain non-vocational courses such as Algebra, Geometry, or General History, provision should be made whereby electives in manual courses such as Farm Shop may be made.

With these various factors receiving consideration, the following curriculum in vocational agriculture is suggested:

FRESHMAN YEAR	
English	1 unit
Biology	1 unit
One vocational unit	
Farm Crops	1 unit
or	
Farm Crops and Horticulture	1 unit
or	
Farm Crops and Dairying	1 unit
Elect one unit	
Farm Shop	1 nnit
Algebra	1 unit ✓

SOPHOMORE YEAR	
English	1 unit
One vocational unit	
Animal Husbandry	1 unit
or	
Animal Husbandry and Poultry	1 unit
Elect two units	
Geometry	1 unit
Farm Shop and Forge	1 unit
General History	1 unit
Physiology and Hygiene	½ unit

JUNIOR YEAR	
Chemistry	1 unit
One vocational unit	
Dairying	½ unit
Soils and Fertilizers	½ unit
Horticulture	1 unit
Elect two units	
English	1 unit
Commercial Law	½ unit
Commercial Geography	½ unit
Advance Farm Shop	1 unit

SENIOR YEAR	
Physics	1 unit
American History and Civics	1 unit
One vocational unit	
Farm Engineering	½ unit
Farm Management and Accounting	½ unit
Soils	½ unit
Elect one unit	
Economics	½ unit
Sociology	½ unit
Reviews	½ unit
Business English	½ unit

At least one unit of Farm Shop must be elected during the course—preferably in the Sophomore year.

Each vocational unit when offered must be offered a double period daily.

Combination of Freshmen and Sophomore classes, and of Junior and Senior classes and alternation of their courses is recommended when a class enrollment of not more than 20 or 22 would result.

THE DEPARTMENT IN THE HIGH SCHOOL

From the type of curriculum that is suggested above, it is evident that the vocational instruction is presented as a department of the high school rather than as a separate organization functioning independently of the existing school system. The classes in non-vocational subjects and related sciences for vocational pupils will be the same classes in which other pupils in the school are enrolled. In some schools it may happen that such classes will be divided into sections, in which case one section might well consist of the vocational pupils. But in general the non-vocational and the vocational pupils will be grouped in the same classes in all of these subjects.

A corner in the hog pen is sometimes a better meeting place for a class than the classroom. Rawson Animal Husbandry class at work on a ring of hogs.

From this relation of pupils the relation of teachers is established, in that the vocational teacher is likewise a part of the school organization, a member of the faculty, under local supervision, and subject to school administration in so far as such supervision and administration do not interfere with the legal enactment for the promotion of this instruction. The superintendent of schools may be of the same value to the department of vocational agriculture as to the department of English, e.g., by directing qualified pupils to enroll in the department, by assisting the teacher in improving his methods in the classroom, by keeping informed of the teacher's activities, by requiring full-time service for the time employed, and by giving any assistance possible to the teacher's out-of-school activities, such as showing an interest in and, if possible, making an occasional visit to the pupils' supervised home work or to community meetings. On the other hand, it is not expected that the superintendent will ordinarily attempt to pass judgment on the technical instruction offered in agriculture or to assign duties to the vocational teacher such as teaching non-vocational subjects, acting as monitor of the assembly room, or coaching athletics requiring daytime practice, which are not vocational in nature and which would take considerable time from his program of assigned vocational duties.

With such relations expected and understood, no misunderstanding in the development of a department should arise.

SUPERVISED FARM PRACTICE

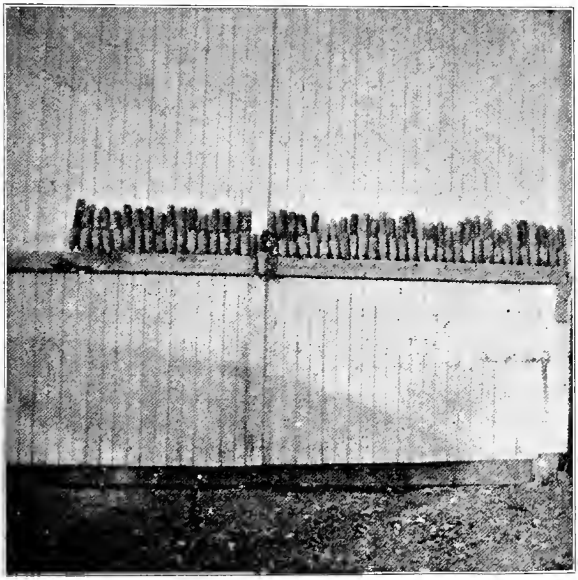
Supervised application of vocational instruction is required of all pupils enrolled in courses in vocational education under the Vocational Educational Act. It is, therefore, required of pupils in vocational agriculture. While to some this phase of vocational education seems to be new and to differentiate it from other types of education, nevertheless it is nothing more nor less than an application of the long-accepted pedagogical principle of "learning by doing" or providing for the realization of the fact that "experience is the best teacher." It is not a new practice in education, as may be observed from practices in many methods of teaching. A pupil learns and becomes a better student in English composition by actually writing compositions, or in argumentation by practice in debating, or in his musical education by hours of application at the piano, or in science courses by laboratory work that provides for an application of the classroom instruction, or in dentistry or medicine by months of practice in clinics. The very fact that these various forms of practical application of instruction have always justified themselves is sufficient reason for requiring an application of farm practice in connection with agricultural instruction of a vocational nature. Just as the dental course would be incomplete without the student's application in the clinic, so a course in vocational agriculture would be incomplete without a period of application in farm practice. It is the purpose of the practical work that it make the pupil's education, in part at least, vocational in nature.

These New Bremen boys are combining theory with practice in their study of drainage in a very commendable manner.

With such a purpose understood for requiring supervised farm practice, what may constitute satisfactory practice and under what conditions may it be performed? The place to acquire satisfactory farm practice is under farm conditions, because there the practical work of the school would be on a scale comparable with actual farming. The pupil's home farm is of unequaled desirability as a place for supplying these conditions, for besides being a place where actual farm practices prevail, there is in addition the pupil's interest in the activities and developments on this farm—a valuable asset. The pupil is also in close contact with the practices employed the year around. Furthermore, the paternal interest of parent in son will greatly enhance the benefits from such an arrangement.

If the pupil preparing for the vocation of farming does not live on a farm, then he must provide for practical farm work or it must be provided for him some place where he can arrange for satisfactory supervised practice under farm conditions. This may be on a school farm or on another farm where he may engage to work. For the most part, the school farm is impracticable, since it involves an investment in land, buildings, stock, and equipment so great that adequate returns are not paid. Anything less than a complete school farm, a few acres of land, for example, is not satisfactory, since it does not provide for practice in connection with many subjects in the curriculum, such as Animal Husbandry, Dairying, Engineering, etc. More frequently such a vocational pupil will be able to arrange for satisfactory practice on a farm where he secures employment in connection with his school work. This is commendable and can be arranged satisfactorily.

Pupils who may wish the instruction without the farm practice are not meeting the essential requirement for vocational instruction and are, therefore, not qualified to enroll. For these pupils a course in general agriculture would be of value.



Intensive projects are as effective as extensive projects if properly managed. Corn-breeding project by the ear-to-row method. Harold Granger, Hillsboro Department.

The scope of the project next deserves consideration. The project must be large enough to employ actual farm operations, for it is only farm operations with which the pupil will be concerned when he undertakes farming as a vocation. To obtain this end it will be necessary to demand an amount of practice that will make actual farm operations necessary. For this reason a project of a field of six or eight acres of corn will be acceptable because it necessitates the use of approved farm practice, whereas a boy might grow an acre of corn and secure equal or better results, but which would be due to practices that would not be of value to him as a farmer; or the boy with at least two or three sows and litters will receive practice in swine management in keeping with the business of farming, whereas a boy with one or two pigs

Studying Farm Engineering where Farm Engineering is practical. A field trip to study a tiling machine in operation. Harmony Township.

might make more economical gains which would be due to employing practices which he would not consider using on a farm. By maintaining a standard for project work such that actual farm operations must be employed, all "play work" or "toy farming" is eliminated and a standard will be maintained which will appeal to and be approved by every boy who is actually interested in farming.

In crop production a separate field as a project is far more desirable than a portion of a field, since then all the operations on the project are definitely known; whereas when, for example, a few acres in a field of corn constitute the project, work on the project proper is not clearly separated from work on the remainder of the field, with an attendant loss of interest. On the other hand, a project may be too large for the boy's best efforts, and interest cannot be maintained. For example, more than fifteen acres of corn would not be recommended for most boys, while a field of from six to twelve acres generally proves highly desirable and within the ability of the pupil to manage.

The relation of the practical work to the agricultural subjects studied is apparent. A pupil making a study of Animal Husbandry is not any better prepared, generally speaking, to grow farm crops, and for that reason practical work in crop production would be unsatisfactory. Therefore the practice must be related to the particular agricultural subject studied in the classroom. If a pupil is able to satisfy project requirements in one subject, Animal Husbandry, for instance, and not in another, Farm Crops, he must wait until the course in Animal Husbandry is offered rather than be allowed to substitute an Animal Husbandry project in the Farm Crops course. Continuation projects constitute an approved exception. If a boy conducts a project such as corn breeding and improvement, or begins to keep purebred livestock, such work should be continued, in order that the best results may be secured. It would thus be acceptable to approve such a project as a continuation project even though not related to the agricultural course of that particular year if it is impossible or impracticable for the boy to conduct two projects.

The extent of the project should be considered from the standpoint of farm operations. If it is a project in corn production, let it begin with seed selection and storage and carry through to field selection of seed and marketing the crop; if in pork production, let it begin with the selection of the brood sow and continue through the breeding, farrowing, and feeding periods until the pigs are marketed. The farmer's practice actually follows such a course. Let him who is preparing to farm acquire practice from a similar procedure.

Accounting and farm practice should be closely related on every farm, and there is evidence that they are becoming so. The pupil in farm practice should, therefore, become trained in the fundamentals of Farm Accounting. To that end, simple records and accounts must be kept, covering inventories, expenses, labor records, income, etc., as essential for a thorough understanding of practice in Farm Accounting. Account books are furnished the pupils for such records.

Briefly, satisfactory practical work may be said to be a businesslike application of approved farm practice under actual farm conditions and extending through the farm cycle.

With these requirements as guides, each pupil should be able to select a satisfactory project which has the approval of the father and the teacher. The selection of a project should also involve the interest of the pupil, his home conditions, and his classroom instruction. Throughout the course the pupil, the parent, and the teacher should constitute a cooperative partnership. Project organization should consist of a plan made by the pupil under the direction of the teacher and with the approval of the parent, whereby he expects to bring his project to a successful conclusion both educationally and financially. This plan will be corrected and improved as the pupil progresses in his classroom instruction.

Project supervision on the part of the teacher should be considered as a teaching process in a class consisting of one pupil. On each visit to the pupil's project the teacher should test the pupil's understanding of the various phases of practice which he is using, has used and will use.

The pupil's participation in his project should be both physical, managerial, and financial. While it cannot be expected that a pupil will perform all the labor on every project that might be chosen, nevertheless he must assume the responsibility for the success of his particular farm practice and either perform or direct all the operations connected with it. Whenever it becomes necessary for additional help to be secured, a record of that labor should be kept also. Assuming the responsibilities of managing the project by the boy is the greatest educational benefit that the boy can receive from project practice. Too much attention cannot be given this feature by teacher and parents. Participation in the financial results of a project should always be encouraged as a very effective means of increasing the pupil's interest in agriculture. No requirement to this effect has been made, but every possible encouragement to this end is recommended.

As an example of what might constitute projects of satisfactory scope, the following list is submitted, with the explanation that an understanding of home conditions and agricultural practices should guide the teacher in determining the maximum and the minimum scope of projects allowed in any particular community:

1. A field of corn, 5 to 10 acres.
2. Potatoes, 1 to 3 acres.
3. Breeding pure seed corn.
4. A new crop—soybeans, alfalfa, cow or field peas.
5. Hog management, 3 sows and litters.
6. Pork production, 25 weaned pigs.
7. Calf raising, 5 to 10 calves.
8. Sheep raising, 30 lambs.
9. Dairy herd production records, 8 cows.
10. Dairy herd management, 5 cows.
11. Orchard management, 15 to 20 trees.
12. Market gardening, ½ to 1 acre.
13. Poultry management, 40 hens or an incubator.
14. Fertilizer trials and crop production.
15. Drainage surveys.
16. Concrete and carpentry constructions.
17. Farm accounting.

A WINTER SHORT COURSE IN AGRICULTURE

The winter short course in agriculture constitutes a very helpful agency in providing an opportunity for farm boys, farm help and even interested farmers to secure additional scientific knowledge in practical agriculture. The usual season for presenting such a course is during the slack time on the farm, approximately from either December 1 or January 1 until attendance diminishes due to the demands of the farm for labor.

In contemplating a short course in a community, one of the first questions that arises is, will a short course in agriculture serve the community? The teacher should become acquainted with the young men or farmers who would be served by such a course. Contact must be had by personal visits rather than through letters or newspaper articles, although the latter

Justin Wahl, West Lafayette, and two of his 22 steers—an excellent project. When asked if he would give up the agricultural course he tapped his head and replied, "Not while I'm right up here."

are of service in addition to personal interviews. The number enrolled need not be large. While a class of fifteen or more would be desirable, a class of five or six might easily make the course worth while.

After assurance of an enrollment is secured, the date to begin the course should be decided. The wishes of those enrolled will determine this. In some years or communities January 1 will be the most satisfactory date, while in others the work may be begun in December.

The course of study offered will be determined by three factors: the length of day when the class is in attendance, the availability of a farm shop, and the demand for non-vocational subjects. Assuming that the class enrollment is made up largely of young people, one of two courses would seem to be desirable. In one the agricultural subjects would be taught by the vocational teacher during the portion of the day when his regular high school classes are not in session, together with Farm Shopwork directed by the Manual Training teacher during the remaining portion of the day. This is the most helpful and most highly recommended procedure. The other course would be offered in the event that no farm shop is available. The agricultural subjects would be offered at the same time as in the course mentioned above, but in place of Farm Shop, special courses in academic subjects—Business English, Arithmetic, Civics, etc., whatever would best meet the needs of the pupils—might be offered to complete the day's schedule.

The third course that might be pursued would be offered in the event that the short course pupils could not attend school more than a portion of the day, and is especially recommended when the enrollment is made up of more mature people, farmers of twenty-five years of age or older. In such a case it would be desirable to offer only agricultural subjects, the schedule for which would have to be arranged at a time not to conflict with the regular classes of the vocational teacher. With this more mature group the form of presentation will consist of informal discussions and prepared talks rather than of assignments made to the class.

Occasionally best results may be secured by arranging for an evening class in place of any of the day programs described above. In such cases the general procedure would be similar to that last mentioned above, in which instruction in agricultural subjects only would be given and for as long a period as the class could meet.

The enrollment in the short course will probably change from year to year and, therefore, it will not be necessary to arrange the course one year with a view to building upon it for the course to be presented the following year. Thus each winter short course will usually be a unit in itself. The agricultural subjects offered in any short course should be determined largely by the needs of those enrolled. It is very probable that desirable courses can be selected from the following: care and feeding of livestock, sheep management, dairying and milk testing, farm arithmetic, elementary soil studies, farm poultry management, orchard management, grain judging, etc. With the selection of subject matter that will serve those in attendance to the best advantage, and by conducting the work daily over as long a period as the group will attend, a form of short course may be arranged which will allow for all the variation necessary to meet the needs of any community.

COMMUNITY WORK

The vocational teacher has an opportunity to render valuable service to the community in addition to the instruction given in the classroom. The

amount of time available would naturally vary with the ability of the teacher and, in part, with the number of pupils enrolled in the department. The teacher with a large department must of necessity give more time to the preparation of material for instruction and to the organization and supervision of projects than the teacher with a smaller enrollment. Most any community has need for the services of an agriculturally trained leader who can be of assistance in providing better agricultural, educational, and social conditions for the rural people. His special training in the agricultural field should qualify him to render local assistance by obtaining information on questions of

The Farm Shop course supplements the agricultural studies by providing farm conveniences and equipment that are always in demand. West Lafayette Farm Shop projects.

agricultural practice. In cooperation with the local organization of the farm bureau and the county agricultural agent, his services should be of value in the promotion of the farm bureau program in his local community. In all community activities affecting the program of the county agricultural agent and in employing the services of Agricultural Extension specialists, the service of the vocational teacher is under the direction of, or in cooperation with, that agent. If desired as local leader of boys' and girls' club work, he may be of service, particularly where such leadership would tend to build up the enrollment of the vocational agricultural department. In the promotion of group community interests, as well as in lending assistance to individuals, the vocational teacher who measures up to his task should play an important part.

PROJECTS IN 1919-1920

A summary of the projects approved this year in the various departments gives a general idea of project work.

The largest number of projects elected are in Farm Crops and Animal Husbandry, as these courses are taught in more departments this year than other courses are, and the enrollment in these classes is always larger than in the more advanced classes. In Farm Crops, the most satisfactory project for the application of a variety of practices is provided in caring for a cultivated crop and therefore corn production from seed selection until the crop is harvested is the most commonly selected phase of farm practice.

This year 225 boys have selected projects of this kind. The size of these projects has varied from the breeding plot of a part of an acre in which the ear-to-row method of corn improvement is practiced, to a field of 25 or 30 acres where the growing of corn for market purposes is the aim. The great majority of corn projects range from five to twelve acres, and consist of a separate field for each project. The average size of the 225 projects is 9.6 acres which is a highly commendable average, in that it assures the employment of actual farm operations.

In Animal Husbandry, swine management is especially commendable as a satisfactory project since it affords opportunity in one year for applying the practice of care and management throughout the cycle of production from brood sow selection to the marketing of stock and selection of breeding stock the following year—an opportunity not provided in the same length of time by projects in cattle, horse, or sheep management. It is therefore of interest to note that the largest number of projects in any one class was elected in swine management and pork production, 300 boys having made such election. The size of these projects varies with agricultural conditions from five pigs to several brood sows and their litters.

Projects in other phases of farm practice have been selected as follows:

Poultry management	110	Cattle Management	42
Dairying	102	Sheep Management	36
Farm Accounting	84	Fruit Growing	32
Soils and Fertilizers	57	Truck Gardening	24
Potatoes	54	Tobacco	7
Engineering	50	Popcorn, Sugar Beets, Soybeans, and miscellaneous	70

In connection with each of these projects, the points of special emphasis are: the cooperation of pupil, parent and teacher, an agreement and an understanding as to the scope and plan of the project, and an understanding as to the pupil's managerial relation to his project and to his participation in the financial returns.

A PUPIL'S EXPERIENCE IN HOME PROJECT WORK

The following story in which a vocational pupil relates his experience in project work, is typical of the possibilities of supervised Farm Practice in connection with the course in Vocational Agriculture:

"I entered High School last September and enrolled in the Agricultural Course. The first day our agricultural teacher explained the work of the year, and said that all Smith-Hughes boys were required to conduct a Home Project, on their own farms, as a part of their agricultural work. We didn't like that at first, because it looked like a fellow had to do a lot of work, and only get one credit. Our teacher must have known what we were thinking, for he said he wanted us to get the idea of doing school work for credit, out of our minds, and to get this attitude instead:—'Now I am going to get this lesson well, because I can use what I learn all my life. If I get my lessons well, I'll not need to worry about passing the course.' He said that by doing our Home Project work on our own farms, we would discover how interesting farm work can be made, and how much profit there is in farming when one uses approved methods. He also promised to help us with our projects, and said he hoped we would all make a lot of money. I didn't expect to make much, but I was mistaken.

In these hotbeds, Ralph Baldwin, Harmony Township, grew the tomato plants for his ¾-acre of tomatoes which returned $289.84 as his labor income.

"On November 25 the agricultural teacher came to my home and helped me weigh up 27 pigs, that I bought of papa. After comparing several feeds, we finally decided to feed tankage, middlings, and corn in a self-feeder. My father had never used a self-feeder and wasn't very anxious to have me try it, but he finally agreed to let me use it.

"I made the self-feeder out of a horse manger in a stall in a bank barn. Next to this stall is another large room, that we cleaned up for a bedroom, so the pigs would always have a nice warm and dry place to sleep. They also had the run of an open shed, and plenty of good warm spring water to drink.

"On December 10 I reported to the agricultural teacher that I was about out of feed. The next day he spent the whole period in teaching the class how to tell the cheapest and best feeds to buy. We finally decided to continue the corn, middlings, and tankage, and to replace a part of the corn with ground rye, and thus lower the feed cost. I had to buy feed again in January, when we again made calculations in class so as to tell what were the best feeds to buy.

"The pigs did better than any we have ever raised. One died, but the others made such economical gains, that the herd still made a very nice profit. The first time the agricultural teacher came to my home to help me weigh the porkers, we put three in a grain sack at each weighing. Only six weeks later, we had to weigh each one separately in a crate. On March 31, when they went over the scales, papa said they were the nicest bunch of pigs that he had ever seen, at their age. It cost me 12.6c. to produce a pound of pork. Each bushel of corn I fed gave me a return of $2.01 per bushel. I made 20c. an hour for all the time I worked on my project, and besides made a profit of almost $75.00 a month and went to school. Papa and I are certainly well pleased with the self-feeder for hogs. We are starting another bunch on the partnership plan this time, and they are doing well. Papa says, 'We can produce pork for ten cents a pound if we have hogs of good type, feed them on the most economical ration, and have no deaths in the herd.'

"All is not gold that glitters"—some of it is hot sunshine. One occasion when the vocational teacher finds it difficult to "keep cool."

"I certainly like the agricultural course, and have changed my mind about farming. I used to think a fellow couldn't make much on a farm, and that farming wasn't very interesting. I know now that you can make lots of money on a farm when you know how, and you can have a good time doing it.

Walter Fenner,

Hillsboro High School."

Departments of Vocational Agriculture, Februiary, 1920

School	County
Allen Township (Van Buren, Ohio)	Hancock
Antwerp	Paulding
Ashland	Ashland
Ashley	Delaware
Berlin Heights	Erie
Bethel Township (New Carlisle, R. F. D.)	Miami
Bloomville	Seneca
Bluffton	Allen
Brookville	Montgomery
Cadiz	Harrison
Caldwell	Noble
*Canal Winchester	Franklin
Chagrin Falls	Cuyahoga
Delta	Fulton
Edison	Morrow
Fayette	Fulton
Gallipolis	Gallia
Gibsonburg	Sandusky
Grand Rapids	Wood-Lucas-Henry
Greenspring	Sandusky-Seneca
*Grove City	Franklin
*Hamilton Township (Lockbourne, R. F. D. 2)	Franklin
Harmony Township (Plattsburg, Ohio)	Clark
Hebron	Licking
*Hilliard	Franklin
Hillsboro	Highland
Jefferson	Ashtabula
Lancaster	Fairfield
Lanier Township (West Alexandria, Ohio)	Preble
Leipsic	Putnam
Malta-McConnelsville	Morgan
Medina	Medina
Millersburg	Holmes
Minerva	Stark-Carroll-Columbiana
Monroe Township (Eldorado, Ohio)	Preble
Mt. Zion Consolidated (Bucyrus, Ohio)	Crawford
New Bremen	Auglaize
New Vienna	Clinton-Highland
Olmsted Falls	Cuyahoga
Paulding	Paulding
Pleasant Township (Marion, R. F. D. 7)	Marion
Raccoon Township (Rio Grande, Ohio)	Gallia
Ravenna Township (Ravenna, Ohio)	Portage
Rawson	Hancock
Ridge Township (Van Wert, Ohio)	Van Wert
Salem Township (Urbana, R. F. D. 3)	Champaign
Salt Creek Township (Kingston, R. F. D.)	Pickaway
Sidney	Shelby

Superintendent	*Teacher*	*College*	*Year*
C. D. Hindall	T. R. Brownlee	O. S. U.	1920
W. C. Kunce	C. B. Waters	Michigan	1916
J. A. McDowell	Harvey Byers	O. S. U.	1919
E. C. Reed	E. O. Bolender	O. S. U.	1916
R. W. McWilliams	J. M. Whitney	O. S. U.	1916
S. A. Frampton	C. R. Runk	O. S. U.	1919
Ralph Hathaway	M. L. Jordan	O. S. U.	1918
C. C. Nardin	T. G. Vickery	O. S. U.	1919
J. E. Fox	C. P. Lang	O. S. U.	1918
C. R. Ridenour	O. E. Hearing	O. S. U.	1919
S. E. Daw	H. A. Purvis	O. S. U.	1919
A. B. Weiser	R. D. Kauffman	Purdue	1917
L. N. Drake	E. W. Budd	O. S. U.	1917
C. C. Smith	J. L. Barnhart	O. S. U.	1914
A. M. Harshbarger	L. N. Geiger	O. S. U.	1918
W. J. Clark	L. J. Smith	O. S. U.	1917
W. G. Scarberry	H. W. Walter	O. S. U.	1919
J. C. Twinem	Robert Weimer	Delaware	1916
J. M. Diley	V. G. Applegate	O. S. U.	1918
W. V. Wales	L. D. Mennell	O. S. U.	1916
C. M. Lehr	H. W. Nisonger	O. S. U.	1914
George Carr	J. B. Lane	O. S. U.	1917
Karl Hirtzinger	Harry Atwood	O. S. U.	1915
E. T. Osborn	Stanley Porter	O. S. U.	1915
A. W. Stewart	F. H. McMillen	O. S. U.	1917
O. C. Jackson	Thos. E. Berry	O. S. U.	1918
G. M. McCommon	H. W. Cleeves	Cornell	1918
J. R. Clements	J. W. D. Butcher	Washington State	1915
		M. S. Wash. State	1916
Walter Waggoner	O. E. Barker	O. S. U.	1920
W. A. Amstutz	H. L. Kern	O. S. U.	1918
B. F. Fulks	S. L. Ruddell	O. S. U.	1912
W. E. Conkle	A. C .Kennedy	O. S. U.	1915
A. C. Pence	Geo. H. Krill	O. S. U.	1918
J. A. Smith	Olen J. Shong	O. S. U.	1917
L. F. Schieser	P. G. Campbell	O. S. U.	1917
I. T. Beck	I. T. Beck	Purdue	1915
E. W. Jordan	O. P. Gossard	O. S. U.	1915
W. O. Moore	W. F. Bruce	O. S. U.	1911
G. C. Imhoff	R. E. Steen	O. S. U.	1916
J. H. Finley	H. A. McMichael	Iowa State	1913
Foster Campbell	Foster Campbell	Iowa State	1907
S. H. Bing	Luke Cooperrider	O. S. U.	1917
Jeanette Risdon	O. J. Price	Purdue	1915
		M. S. Purdue	1918
Homer R. Dunathan	G. K. Sivaslian	O. S. U.	1914
W. F. Henney	J. T. Wilcox	O. S. U.	1918
H. H. Petty	W. R. M. Scott	M. S. Purdue	1918
C. O. Edington	L. E. Barb	O. S. U.	1919
H. R. McVay	W. A. North	O. S. U.	1917

School	County
St. Clairsville	Belmont
Stryker	Williams
Sugar Creek	Tuscarawas
Sugar Creek Township (Vaughnsville, O.)	Putnam
Tully Township (Martel, Ohio)	Marion
Versailles	Darke
Wapakoneta	Auglaize
Washington C. H.	Fayette
Wellington	Lorain
West Lafayette	Coshocton
West Milton	Miami
Wheelersburg	Scioto
Wooster	Wayne
*Worthington	Franklin

*These departments are used for Teacher Training by the Ohio State University.

A SUGGESTED LIST OF BOOKS FOR THE AGRICULTURAL REFERENCE LIBRARY

(Numbers in parentheses refer to publishers)

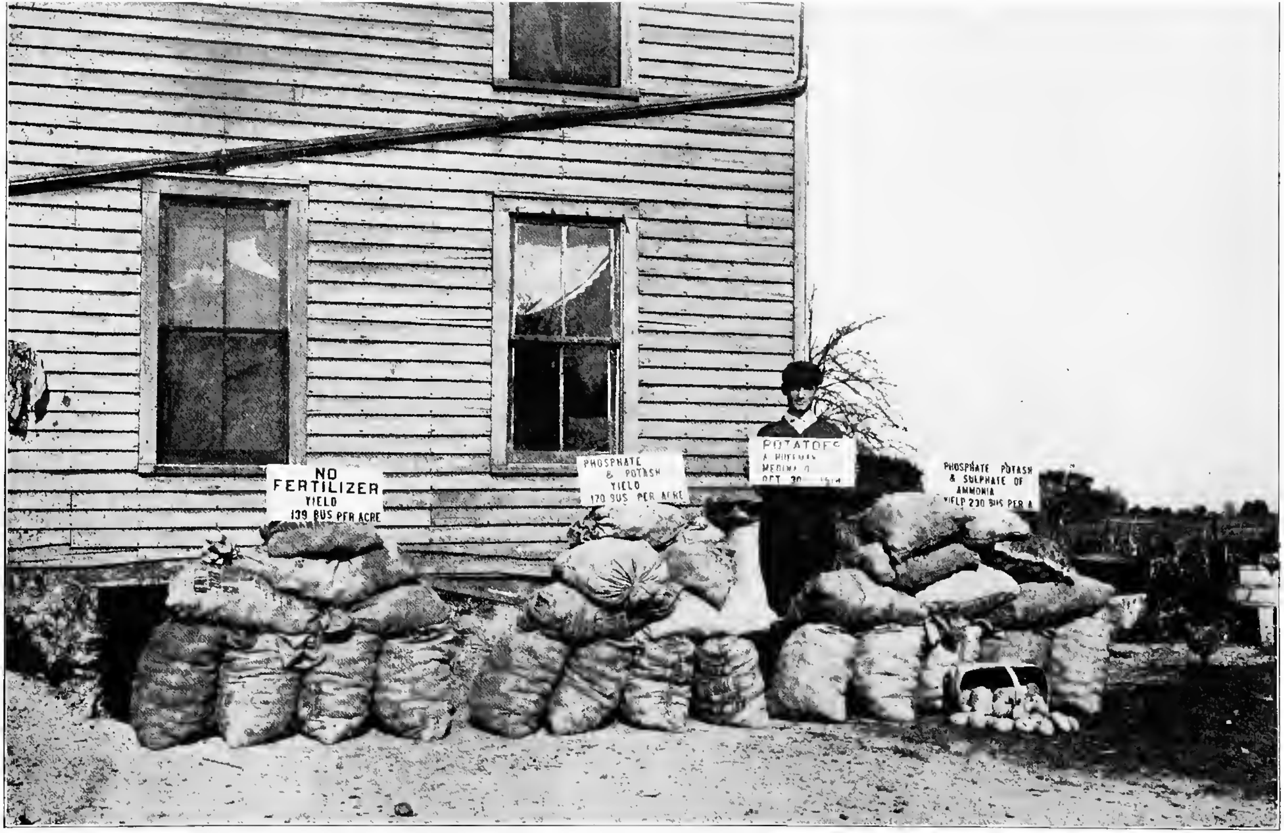
Goff, Moore, Jones, The Principles of Plant Culture (8th edition). (1).
Bowman, Corn. (4).
Fraser, The Potato. (3).
Clark, Field Weeds of Canada. (17).
Georgia, Manual of Weeds. (1).
Wing, Meadows and Pastures. (9).
Piper, Forage Plants. (1).
Voorhees, Forage Crops, Etc. (1).
Stevens and Hall, Diseases of Economic Plants. (1).
Sanderson, Insect Pests of Farm and Garden. (6).
O'Kane, Insect Pests and Their Control. (1).
The K. C. Davis series of reference books: (13).
    Montgomery, Productive Farm Crops
    Davis, Productive Plant Culture
    Sears, Productive Orcharding
    Lloyd, Productive Vegetable Gardening
    Gay, Productive Horse Husbandry
    Day, Productive Swine Husbandry
    Coffey, Productive Sheep Husbandry
    Washburn, Productive Dairying
    Pellett, Productive Bee Keeping
    Craig, Common Diseases of Farm Animals
    Lewis, Productive Poultry Husbandry
    Washburn, Injurious Insects and Useful Birds
    Weir, Productive Soils
Card, Bush Fruits. (1).
Wilkinson, The Apple. (2).
Cridland, Practical Landscape Gardening. (18).
Harper, Manual of Farm Animals. (1).
Plumb, Types and Breeds of Farm Animals. (2).
Craig, Judging Livestock. (15).
Plumb, Judging Farm Animals. (3).

Superintendent	*Teacher*	*College*	*Year*
J. H. Brill	Ralph Richardson	O. S. U.	1918
W. E. Huffman	O. C. Rogers	O. S. U.	1916
T. G. Syler	C. H. Ross	O. S. U.	1917
V. C. Snyder	E. J. Grener	O. S. U.	1918
M. A. Shepard	W. W. Montgomery	O. S. U.	1918
W. E. Beeman	L. R. Dunstan	Michigan	1919
F. E. Reynolds	C. M. Hampson	O. S. U.	1915
Wm. McClain	J. A. Harbaugh	Purdue	1917
E. S. Kerr	D. G. Swanger	O. S. U.	1916
G. C. Schurtz	A. E. Halterman	O. S. U.	1920
A. D. Hannum	S. H. Swartztrauber	O. S. U.	1916
E. O. McCowen	Fred R. Keeler	O. S. U.	1918
G. C. Maurer	H. M. Doyle	Cornell	1912
H. C. Fickell	R. H. Schreiber	Purdue	1917

Henry and Morrison, Feeds and Feeding (latest edition). (8).
Henry and Morrison, Feeds and Feeding (abridged). (8).
Mumford, Beef Production. (20).
Kleinheinz, Sheep Management. (16).
Farrington and Woll, Testing Milk and Its Products. (19).
Lewis, Poultry Keeping. (13).
Lippincott, Poultry Production. (7).
American Standard of (poultry) Perfection.
Vivian, First Principles of Soil Fertility. (3).
Voorhees, Fertilizers. (1).
Snyder, Soils and Fertilizers. (1).
Burkett, Soils. (3).
Vivian, Everyday Chemistry. (12).
Jeffrey, Text Book on Farm Drainage. (1).
Elliott, Practical Farm Drainage. (6).
Russell and Hastings, Agricultural Bacteriology. (11).
Conn, Bacteria, Yeasts, and Molds. (2).
Roehl, Farm Woodwork. (14).
Roehl, Agricultural Woodworking. (14).
Brace and Mayne, Farm Shopwork. (12).
Cobleigh, Handy Devices and How to Make Them. (3).
Shutts and Weir, Agricultural Arithmetic. (5).

LIST OF PUBLISHERS

1. Macmillan Company, Chicago.
2. Ginn & Company, 199 East Gay St., Columbus, O.
3. Orange-Judd Company, Chicago.
4. Waterloo Publishing Company, Waterloo, Iowa.
5. Webb Publishing Company, St. Paul, Minn.
6. John Wiley & Sons, New York City.
7. Lea & Febinger, Philadelphia.
8. Henry & Morrison, Madison, Wis.
9. Sanders Publishing Company, Chicago.
10. Sturgis & Walton Company, New York City.
11. E. G. Hastings, Madison, Wis.



Arthur Huffman, Medina, combined the growing of three acres of potatoes and one acre of popcorn with fertilizer trials and demonstrated to his satisfaction the value of certain fertilizers on his farm. His labor income from his project was $574.78.

12. American Book Company, Cincinnati, O.
13. Lippincott & Sons, Philadelphia.
14. Bruce Publishing Company, Milwaukee, Wis.
15. Kenyon Company, Des Moines, Iowa.
16. Frank Kleinheinz, University of Wisconsin, Madison, Wis.
17. Government Printing Bureau, Ottawa, Canada.
18. De La Mare Company, New York City.
19. Mendota Printing Company, Madison, Wis.
20. F. C. Mumford, University of Illinois, Champaign, Ill.

AGRICULTURAL APPARATUS

Apparatus need not be duplicated if it is available from other science laboratories whenever needed. As an aid in selecting apparatus, the following suggested list is submitted:

Nests of beakers, 50cc., 100cc., 250cc., 500cc.
Wash bottles.
Evaporating dishes, 3-in., 5-in.
Watch glasses, 3-in.
Water bath.
Test tubes, holders, etc.
Mortar and pestle, 4-inch porcelain.
Soil cylinders (may be made by cutting bottoms from large cylindrical glass bottles).
Soil auger, 36-in. handle.
Capillarity tubes, set of seven.
Capillarity tubes, ¾-inch, 1 in. x 3 ft., 5 ft.
Lamp chimneys, student lamp type.
Paper flower pots, 4-in. or assorted sizes.
Truog soil acidity tester.
Litmus or litmus paper.
Drying oven, gas.
Ideal corn tester, 400- or 800-ear. (Manufactured by National Manufacturing Company, Des Moines.)
Germinating plates and blotters.
Grain sieves and grader. (For seeds and soil.)
Government case of seeds of 100 weeds—U. S. D. A., Washington, D. C.
Speco mounts, ½ doz. No. 5, ½ doz. No. 6. (Specialty Manufacturing Company, St. Paul, Minn.)
Grain receptacles, covered, ¼-½ bu. size, or
Sectional cabinet, with drawers in assorted sizes for grains, grass, and weed seed storage. (W. C. Heller & Co., Montpelier, Ohio.)
Measures, assorted sizes, wood or metal.
Samples of grain and grasses—seed, 8-oz. bottles.
Score cards for wheat, corn, oats, barley.
Budding knife.
Pruning knives.
Pruning shears, short handles.
Pruning shears, long handles.
Pruning saw, swivel blade.
    Extra blades.
Tree pruner, extension handle.
Binding tape.
Sprayer, brass, knapsack or barrel.

The Inter-High School Livestock Judging Contest affords keen competition in developing the ability of boys to judge all classes of livestock. Grand Rapids, Stryker, Fayette, Wauseon, and Delta Judging Teams.

Garden trowel.
Grafting wax material.
Commercial insecticides and fungicides.
Insecticide and fungicide material.
Bottles and vials for preserving insect larvae, etc.—2-dram, 1-oz., 4-oz., and 8-oz.
Riker mounts for types in mounting—8 in. x 12 in., 5 in. x 7 in.
Glass (5x7, used photographic plates), glass cutter, heavily gummed cloth tape, and absorbent cotton for making mounts. 50 frames, 5 in. x 7 in., made by A. I. Root & Co., Medina, Ohio.
Two cyanide bottles, (large mouth, ground glass stopper).
Petri plates.
Score cards for fruit, potatoes.
Babcock milk tester, complete, 12 bottles, iron case, hinged cover, hand power.
Sulphuric acid.
Milk test bottles, 10% size.
Cream test bottles, 50%, 9-gram size.
Skimmilk test bottles.
Test bottle tank and tray.
Acid measures.
Dividers.
Pipettes.
Acidometer.
Sample bottles or jars (with case) for herd tests from six milkings, ½ pint size.
Sampling dipper, long handle, (may be made locally).
Brushes and cleaners, assorted sizes.
Corrosive sublimate tablets or other preservative.
Acid refuse jar, earthen, covered.
Lactometer, Quevenne's, with thermometer.
Graduated cylinders, 50cc., 100cc., 500cc.
Centigrade thermometers.
Dairy thermometer.
One box Farrington alkaline tablets.
Milk record charts—herd, week.
Milk scale, 60-lb. double pointer.
Cream scale.
Veterinary thermometer.
Milk fever outfit.
Egg tester, (may be made or purchased.)
Incubator and brooder, (may be borrowed or purchased.)
Sanitary drinking fountain.
Caponizing set.
Score cards—horses, beef and dairy cattle, fat hogs, sheep.
Farm level.
Chain or tape, 100 ft., metal preferred.
Trip balances, metric.
Moisture tester for grains, official Brown-Duvell, 1 or 2 compartments. (Manufactured by Seed Trade Reporting Bureau, Postal Telegraph Bldg., Chicago).
High grade microscope, (may be used with science department).

Twenty-five or more selected microscope slides on botanical, crop and insect subjects.
Lantern for slides.
Hand lens, tripod style.
Bulletin file boxes. (H. Schultze & Co., 519 Superior St., West, Chicago.)
Chart materials—cloth and stamping set, 2 or 3 type sizes.
Chemicals, (may be supplied from chemical laboratory).

Agar-agar	Potassium cyanide
Gelatin	Sodium bicarbonate
Beeswax	Calcium chloride
Phenol-phthalein	Calcium carbonate

Bricker Agricultural Charts, (Nos. 1, 9, 10, 11, and 12 especially recommended.)
Picture frames, picture wire, etc., for photos of live stock.

FARM SHOP EQUIPMENT

(Prepared by RAY FIFE)

Tools and Equipment for a Class of Eight Boys

The following are required, one for each pupil:

Bench hook (shop made)
Bench stop (shop made)
Carpenters' hammer, ½ bell face, adz eye, curved claw; ½ plain face, straight claw
Jack plane, 14-inch, iron center
Ruler, two-foot, four fold
Square, try, 9-inch

Number Required	Name and Description
1	Complete set auger bits: 1-4 inch, 5-16 inch, three 3-8 inch, 7-16 inch, 1-2 inch, 9-16 inch, 5-8 inch, 11-16 inch, 3-4 inch, 13-16 inch, 7-8 inch, 15-16 inch, and 1 inch
2	Bits, screw-driver, 3-8 inch and 5-16 inch tip
1	Set square shank, bit stock drills, for wood or metal, four ¾-32 inch, 6-32 inch, 7-32 inch, and 8-32 inch.
3	Brace, rachet, one 8-inch, one 10-inch, one 12-inch
11	Chisels, socket, firmer, one 1-8 inch, one 1-4 inch, one 3-8 inch, two 1-2 inch, one 5-8 inch, one 3-4 inch, one 7-8 inch, two 2 inch, one 1 1-2 inch.
2	Clamps, carpenters' steel bar, 4-foot
2	Counter sink, Rose
2	Dividers, loose leg, wing, one 8-inch, one 10-inch
1	Draw knife, 8-inch
2	Files, mill cut, 10-inch
6	Files, slim taper triangular, 6-inch
2	Files, slim taper triangular, 5-inch
1	File, augur bit
1	File card(cleaner)
2	Gauge marking plane
2	Glass cutter (Red Devil)

1	Grinder, emery or carborundum, high-geared, with one coarse and one medium grit wheel, with foot pedal
1	Level and Plumb, wood, 26-inch
1	Mallet (more if shop made)
4	Nail sets, assorted
1	Oiler
2	Oil stones, coarse (80 grit) and fine (120 grit) face carborundum
2	Pliers, assorted
1	Pincers
1	Putty knife
1	Pinch bar, 2-foot
1	Plane block, adjustable, 6-inch
1	Plane, fore, 18-inch iron, 2-inch cutter
3	Saws, crosscut, 24-inch, 8 or 9 point
1	Saw, crosscut, 22-inch, 10 point
2	Saws, rip, 24-inch, one 6-point, one 7-point
1	Nest compass saw
1	Saw, coping, with dozen blades
1	Saw, hack, 10-inch extension frame, with dozen blades
1	Saw, back, 12-inch
1	Saw set
1	Saw vise (can be shop made)
3	Screw drivers, one 4-inch, one 6-inch, and one 12-inch
2	Sliding T bevels, one 6-inch and one 8-inch
2	Squares, steel, 16-inch x 24-inch, polished (one with rafter framing table)
1	Miter square, adjustable
1	Bench screw, 1-inch, iron (one for each home-made vise)
1	Wrench, monkey, 10-inch, knife handle
1	Center punch
1	Bit expansion, 3-4-inch to 3-inch, Steers patent
1	Vise, blacksmiths' solid box, 3 1-2 inch width of jaw